Title	***Multi-location Vertical Beam Size Measurement for the SR***			
Project Requestor	Michael Borland			
Date	March 21, 2008			
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Machine or Sector Manager	Louis Emery			
Category	Accelerator Hardware and ID Upgrades			
Content ID*	APS_1257983	Rev.	ICMS_Revision	ICMS Document Date

*This row is filled in automatically on check in to ICMS. See Note [1]

Description:

Start Year (FY)	**2009**	**Duration (Yr)**	**3**

Objectives:

To provide vertical beam size measurements at multiple points around the SR in order to aid in understanding and control of coupling.

Benefit:

To improve the ability to tune and reproduce the coupling for lifetime, injection efficiency, and beam tilt control. To validate the coupled machine model.

Risks of Project: See Note [2]

Low.

Consequences of Not Doing Project: See Note [3]

Benefits not realized.

Cost/Benefit Analysis: See Note [4]

Cost needs to be estimated.

Description:

This is part of a multi-proposal initiative aimed at reducing radiation damage and making other operational improvements to the SR. (See Section 1 of OAG-TN-2008-008 for a full description and explanation of the linkage among the parts).

This project is motivated by two new technologies that measures vertical beam size cheaply. ESRF has the ability to measure the vertical beam size at many points in the ring using simple, inexpensive photon diagnostics [K. Scheidt, DIPAC 2007]. Decker has used a vibrating wire monitor [Arutunian, BIW 2008] on a APS BM source point to make vertical beam size measurements as well. Both these techniques measure the vertical beam size in the air just outside the vacuum chamber, which is much cheaper and practical, than say a pinhole or zone plate beamline. Having this measurement capability at many points in the ring would allow APS accelerator physicists to better monitor and tune the vertical beam size (and tilts inferred by model), to ensure that they are optimized and reproduced from day to day.

We need to understand the implementation of the monitors and perform simulation studies to determine how many are needed around the ring and their required resolution (resolution may be a problem because coupling is low). The simulations won't be straight-forward as the monitors measure the distribution of a transformed y-y' beam phase space at the BMs, while the goal is to keep constant the x-y or x'-y' photon distribution at the IDs. It is clear that the resolution of the instruments will be critical for the a meaningful measurement of coupling.

Some engineering effort will be spent determining the best location for monitors in the small space available at the BM vacuum chamber. The location will dictate the best effective resolution possible for the given technology. The two candidate technologies are expected to have different resolution-cost trade-offs.

The purchase, installation and integration into operations of the selected devices into operations will be a separate future project.

Presently-available commercial vibrating wire monitors have intrinsic resolution of 100 microns (compared to 20 micron for the BM pinhole imaging system), and costs around $15k. The imaging method has a intrinsic resolution of about 70 um for $15k. Since we may need better resolution than this for our coupling measurement some additional development on these instrument may be required. The alternative technology with next best resolution would be an extensive $300k zone-plate imaging system in the BM front-end taking away a small slice of dipole fan from the users with a 5 micron resolution. Since this is a big jump in cost, there is some motivation in improving the above two technologies.

Funding Details

Cost: ($K)
Use FY08 dollars.

About 0.2 FTE physicist for the first year to work out concepts and 0.2 FTE engineer to fit instrumentation in small space of BM vacuum chamber. Assume purchase of one instrument of each type in the first year for evaluation and R&D.

Year	AIP	Contingency
1	30k	
2		
3		
4		
5		
6		
7		
8		
9		
Total	30k	

Effort: (FTE)

Year	Mechanical Engineer	Electrical Engineer	Physicist	Software Engineer	Tech	Designer	Post Doc
1	0.2		0.2				
2							
3							
4							
5							
6							
7							
8							
9							

[1] **Notes:**
ICMS. Check in first revision to ICMS as a *New Check In*. Subsequent revisions should be checked in as revisions to that document i.e. C*heck Out* the previous version and C*heck In* the new version. Be sure to complete the *Document Date* field on the check in screen.

[2] **Risk Assessment.** Advise of the potential impact to the facility or operations that may result as a consequence of performing the proposed activity. Example: If the proposed project is undertaken then other systems impacted by the work
include ... (If no assessment is appropriate then enter NA.)

[3] **Consequence Assessment.** Advise of the potential consequences to the facility or to operations if the proposal is not executed. Example: If the proposed project is not undertaken then ____ may happen to the
facility. (If no assessment is appropriate then enter NA.)

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[4] **Cost Benefit Analysis.** Describe cost efficiencies or value of the risk mitigated by the expenditure.

Example: Failure to complete this maintenance project will result in increased total costs to the APS for emergency repairs and this investment of ___ will also result in improved reliability of ____. (If no assessment is appropriate then enter NA.)